(12) UK Patent Application (19) GB (11) 2 005 753 A

(21) Application No 7839404
(22) Date of filing
5 Oct 1978
(23) Claims filed
5 Oct 1978
(30) Priority data
(31) 7176/77
(32) 7 Oct 1977
(33) Austria (AT)
(43) Application published
25 Apr 1979
(51) INT CL² E21C 27/28
(52) Domestic classification
E1F 2
(56) Documents cited
GB 1520984
GB 1386989
GB 1228025
GB 924752
GB 692542
(58) Field of Search
E1F
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(57) There is disclosed apparatus for the working of minerals in mining, particularly underground, which has a loosening tool with recoil effect as component of a mounting, which is braceable between the floor and the roof of a seam and which is three-dimensionally pivotable as well as locatable in the respective operating position by hydraulically loadable thrust piston units. The mounting is subdivided into frame elements (4,5), which are variable in their spacing from each other and braceable between the floor (10) and the roof (11) of the seam by hydraulically loadable props (9,33). The loosening tool (40) is pivotably suspended between roof (11) and floor (10) of the seam at the upper end of a pedestal (35) mounted on one of the frame elements (4,5) to be rotatable about a substantially upright axis (34).

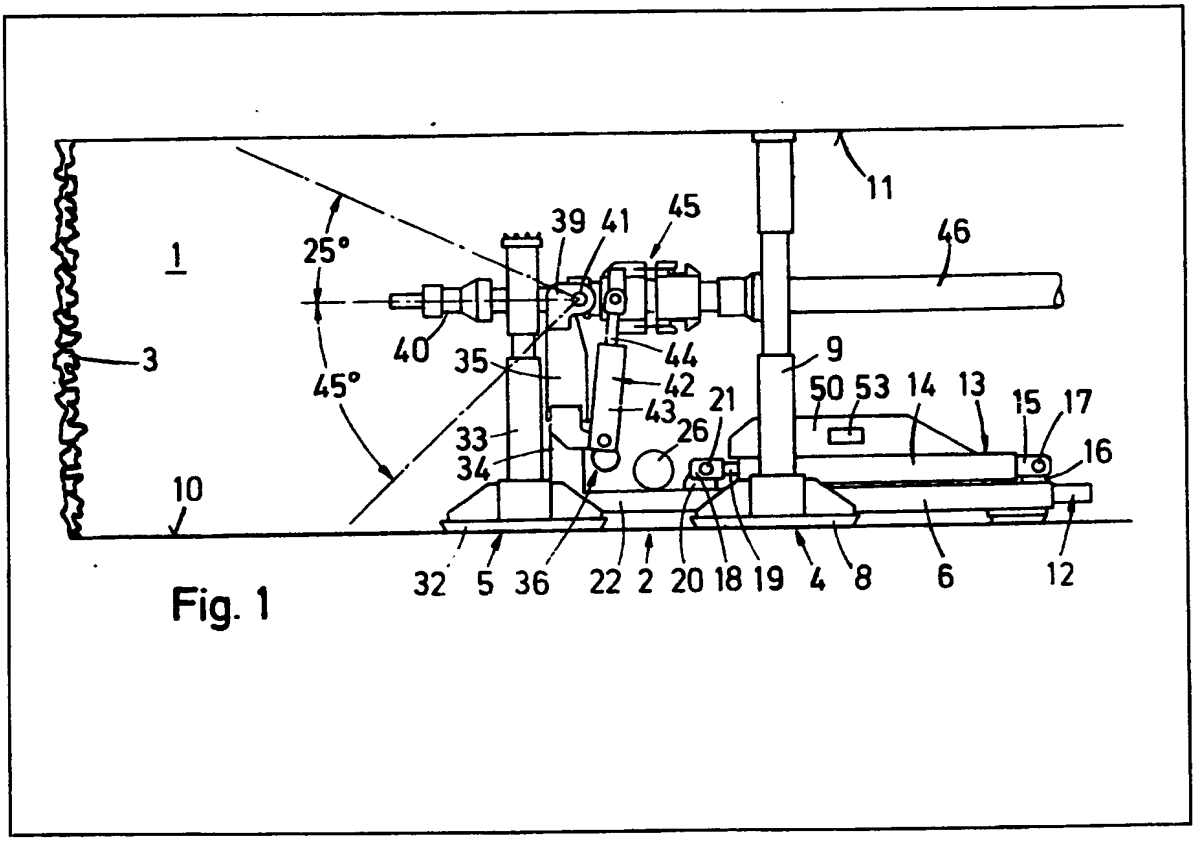

Fig. 1

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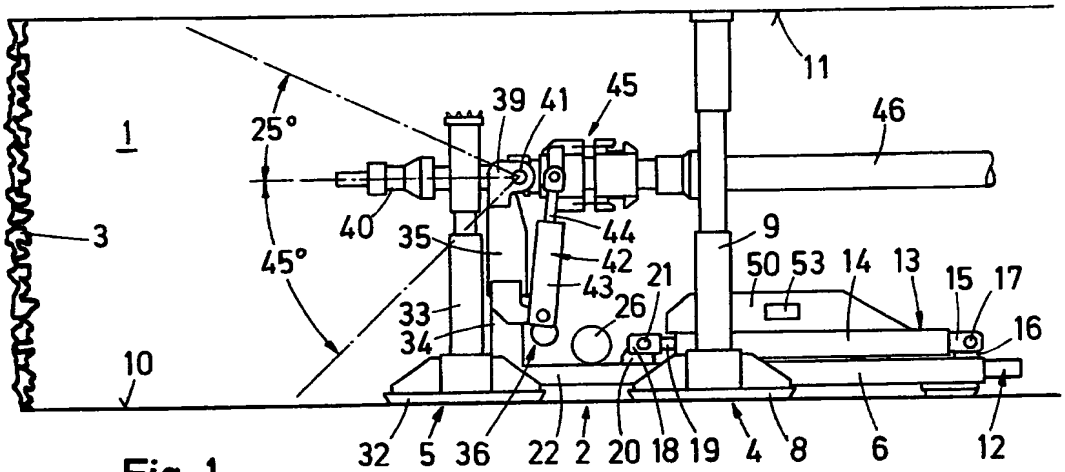
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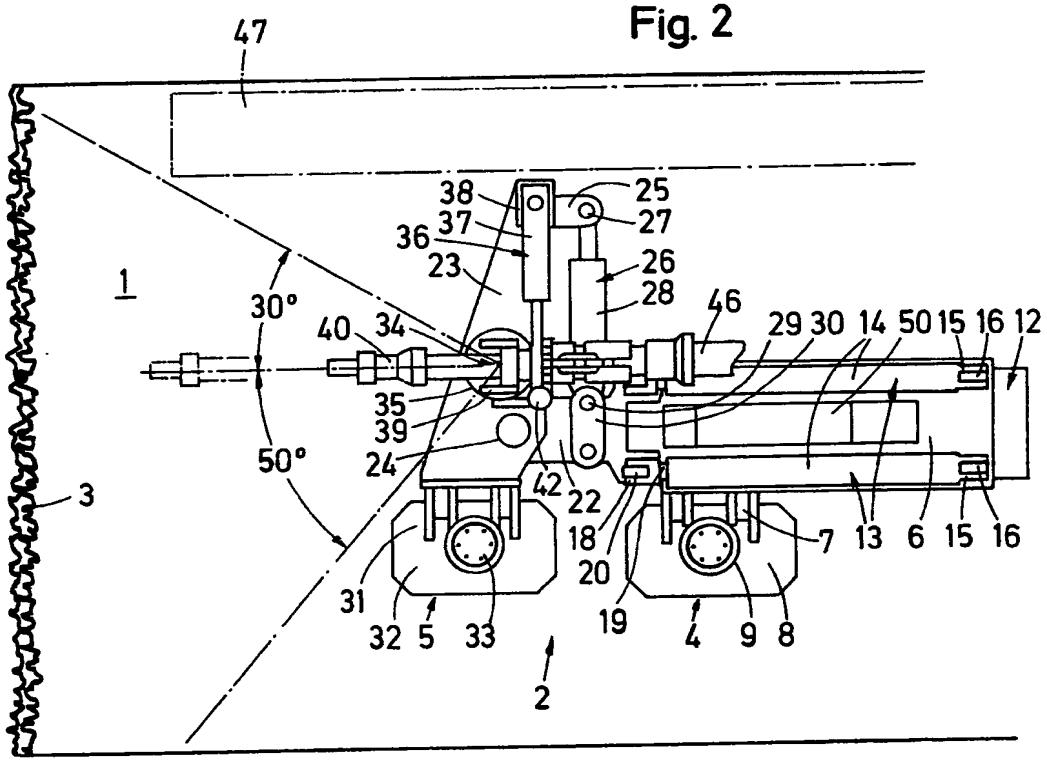
Fig. 1

Fig. 2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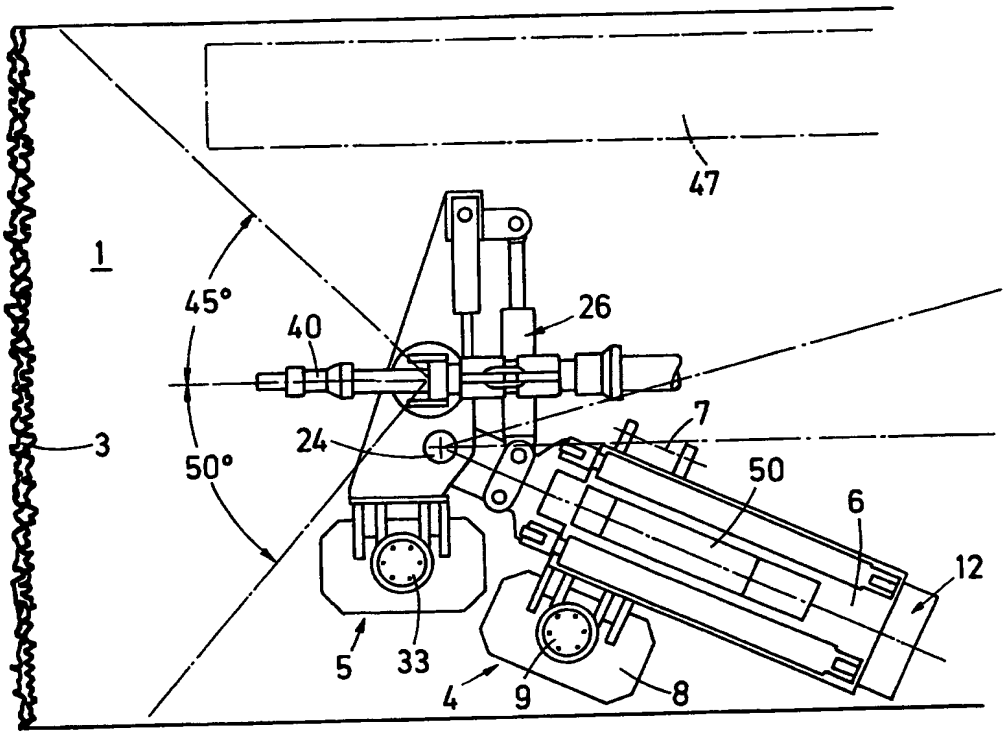


Fig. 3

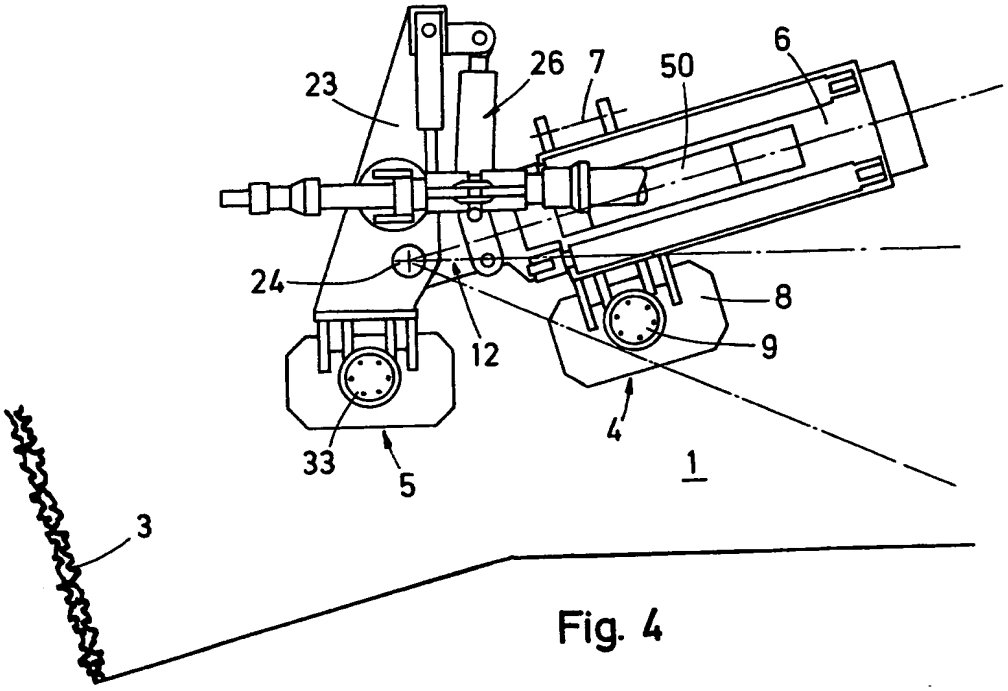


Fig. 4

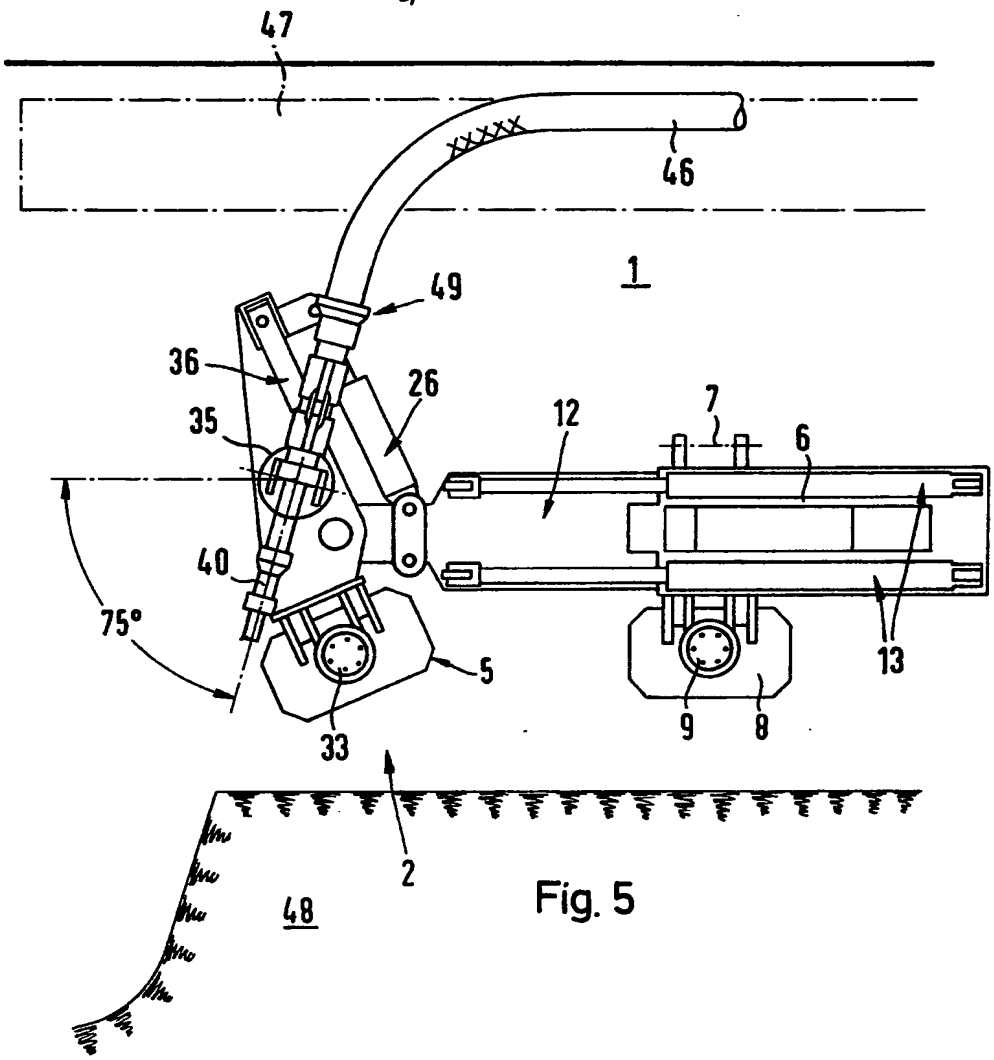


Fig. 5

Fig. 6

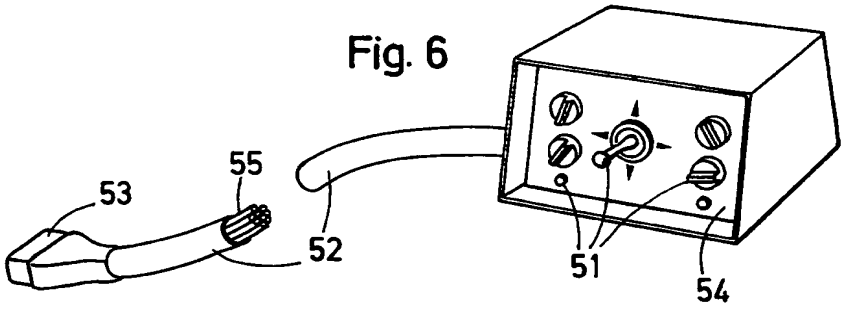
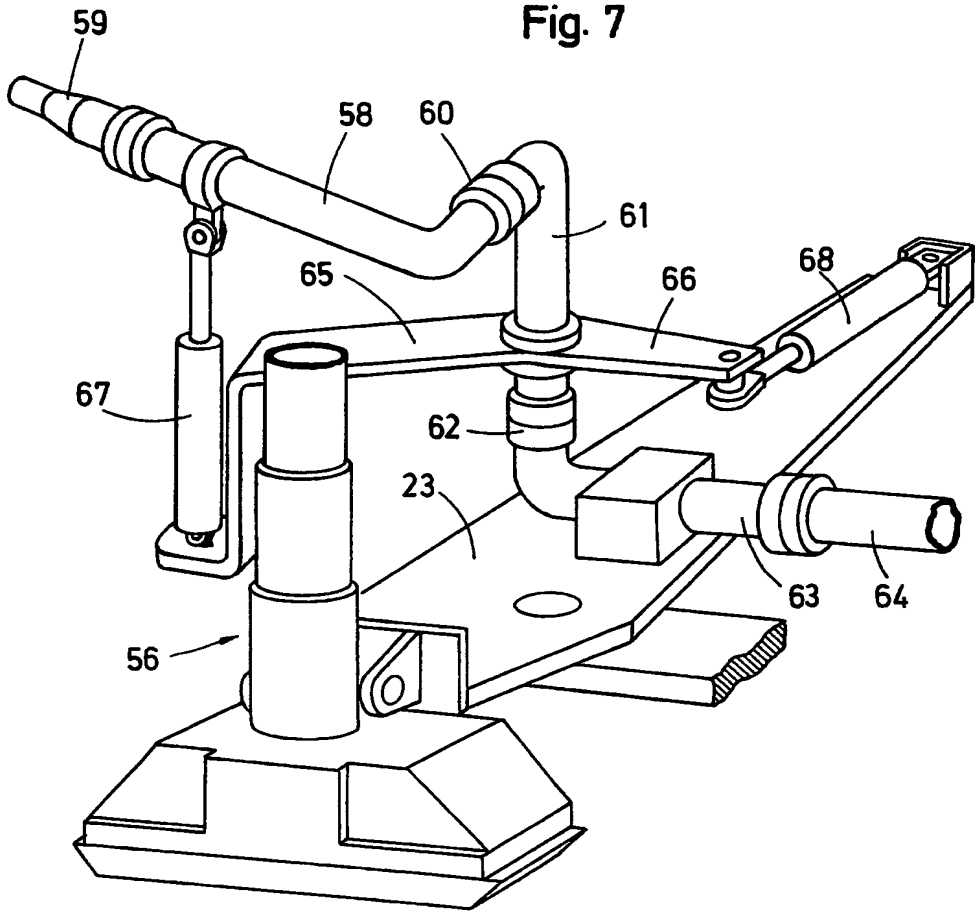


Fig. 7



SPECIFICATION

Apparatus for working of minerals in a mine

The present invention relates to an apparatus for working of minerals in a mine, particularly underground.

In the case of a known loosening tool, there is, for example, provided a heavy impact-drilling equipment which can be used in the seam for the cutting of coal, ore or the like as well as also in the advancing of roads or tunnels. In a known form of construction, the loosening tool is mounted to be pivotable about a vertical axis on the free end of a jib. The pivotation is effected through a hydraulically loadable thrust piston unit which is articulated on the one hand to the jib and on the other hand to the loosening tool. The forwardly projecting jib is mounted by its rear end in a sleeve and rotatable in the sleeve around a horizontal axis with the aid of a hydraulically loadable thrust piston unit. The sleeve forms the component of a mounting which is locatable by means of two clamping saddles to two props which are braceable between the floor and the roof of the seam or between the bed and the gallery roof. The aforementioned pivot axes each lie in a plane running about parallel to the roof or floor of the seam or nearly perpendicularly to the roof or floor of the seam. In this manner, a common definition is assured also in a tilted as well as in a dipping face.

The appreciable effort during translation into the next working position is a disadvantage of the known equipment. Since very heavy parts are concenred in the case of the loosening tool as well as also in the case of the mounting, not only the loosening tool must be at least partially separated from the jib or from the mounting, but also the mounting must be completely detached from the props. The props can be detached, transported forward and again braced in the next working position only after these operations have been performed. After their setting, the mounting is again attached to the props and the loosening tool integrated into the mounting. Furthermore, it is difficult with the known device to perform changes of direction, since the pivotal range of the loosening tool is limited due to its construction. In the case of greater changes of direction, a disassembly of the device and a subsequent re-assembly in the described manner must consequently likewise be performed.

According to the present invention there is provided an apparatus for working of minerals in a mine, the apparatus being provided with a mounting comprising first and second support members, first hydraulically operable means so arranged as to vary the relative position of the support members to thereby locate the mounting in a desired operating position thereof, second hydraulically operable means associated with the first and second support members and arranged to brace the mounting between the roof and the floor of the mine, and a recoilable work tool so arranged on a bracket member mounted to the first support member as to be pivotable about a substantially vertical axis.

Expediently, an apparatus embodying the invention can be made to follow the advanced face head or the adit end without special assembly or disassembly operations, and indeed also in the case of curved travels with a greater course of curvature.

As will be described in detail hereinafter, the mounting is developed as a walking carriage, automatically changing its stepping direction in case of need and comprises at least two frame elements. In consequence of the variability of the spacing of the frame elements from each other, through initial local fixing of one frame element, the other previously detached frame element can be redisposed by the required amount relative to the located frame element as counter-bearing. Subsequently, the previously detached frame element is braced and the frame element braced up till now is detached so that this can now likewise be redisposed by the required amount while being supported on the now located frame element. The location of the frame elements in that case always takes place through the props associated with them.

Apart from the variability of spacing, a variation of the direction of stepping can also however be brought about through the pivotability of both frame elements relative to each other, namely in a plane running substantially parallel to the floor of the seam or to the bed. In connection with the spatial pivotability of the loosening tool, an apparatus embodying the invention may be made to follow in defined direction the face head of a road or a tunnel or the adit of a face without any disassembly or re-assembly effort. All courses of movement can be controlled and monitored from a central switch panel which is accommodatable so far from the frame elements and the loosening tool that an endangering of the operator is completely excluded. Manually to be performed translation operations are completely redundant.

In a preferred embodiment of an apparatus embodying the invention, the loosening tool may be formed by the jet pipe of a hydromechanical extraction device. By reason of the walking capability of the equipment, no difficulties exist in guiding the jet pipe continuously in a defined manner during forward stepping, i.e. on driving to a face, as well as also during the subsequent cutting of the adjoining field in back-filling. This becomes of particular significance because the face is tilted and additionally inclined in this method

of cutting so that the obtained slurry can flow away unobjectionably. Expediently, the walking capability and the braceability of the frame elements lead to a very variable employment in practical underground use.

The frame element carrying the pedestal may be connected through a horizontal hinge with vertical pivot axis and through a hydraulically loadable thrust piston unit with a guide beam which penetrates in longitudinal direction a component of the guide housing forming the other frame element and which is connected through at least one hydraulically loadable thrust piston unit with the guide housing.

The constrained guidance of the frame elements on each other is effected through the combination of guide beam and guide housing. The thrust piston unit functioning as shift unit is articulated on the one hand above the guide housing and on the other hand at the guide beam. Through appropriate loading of the shift unit and of the props associated with the two frame elements, a frame element can accordingly be re-disposed in defined manner with guidance at the other frame element. Changes of direction are in this case readily possible through the combination co-operation of the shift unit effecting the change in spacing between the frame elements and the thrust piston unit which is incorporated between the guide beam and the frame element carrying the pedestal. This swivel unit is preferably disposed in the height region of the guide beam.

The articulation point for the swivel unit at the guide beam is provided in duplicate at both sides. In this manner, also the frame element carrying the pedestal can in case of need be turned through 180° and coupled with the guide beam in this new association. For the change in spacing of the frame elements, it is sensible when preferably at least two thrust piston units are provided, which are then provided to both longitudinal sides of the guide housing and the guide beam, respectively. Space is then available above the flatly kept guide housing between the thrust piston units in order here in a given case to accommodate the drive and control units for the different hydraulic thrust piston units and props of the equipment. The guide beam is preferably guided slidingly in the guide housing. However, a rolling guidance is also feasible.

For the location of the frame elements, at least one hydraulically loadable prop is associated with each of the same. The forces loading the frame elements can however be increased and a firmer anchoring during operation lets itself be attained when at least two hydraulically loadable props are associated with at least one of the frame elements.

Beyond that, a vertically pivotable articulated support skid for the props is preferably laterally associated with each frame element. The support skid is constructed to be plate-shaped or dish-shaped and articulated to the frame elements to be vertically pivotable or movable in height. The guide housing on both longitudinal sides possesses appropriate articulation points so that the support skids can be mounted selectably. The floor sill of the frame element carrying the pedestal thereagainst possesses only one articulation point, since the entire floor sill can be turned in case of need. One prop each time or several props can be mounted on the support skids.

Through the mounting of the loosening tool at the upper end of the pedestal rotatable about a substantially upright or vertical axis (meant by this is the straightest possible connection between the floor and the roof of the seam or between the bed and the gallery roof), the loosening tool can now also be directed pin-pointedly to larger lumps which have broken out of the pile or out of the face head and which had hitherto to be comminuted by laborious additional manual work. Furthermore the working range of the loosening tool can in case of need be enlarged by a substantial amount through an appropriate oblique setting of the frame elements to each other without these measures being obstructed by the energy supply lines.

According to an embodiment of the invention, the loosening tool is mounted on a swivel fork provided at the upper end of the pedestal and pivotable between roof and floor of the seam through an hydraulically loadable thrust piston unit articulated to the pedestal. The thrust piston unit is in this case preferably disposed laterally of the pedestal, constructed for example in the manner of a sleeve, so that the loosening tool has a great displacement range in the swivel fork. Thus, with a stroke of the thrust piston unit of for example 145 millimetres, a swivel extent through 25° upwardly and 45° downwardly of the loosening tool axis, disposed about 700 millimetres above the floor and running about parallel to the floor of the seam, is possible. In a further embodiment of the invention, the pedestal is mounted on a floor sill of the frame element and pivotable through an hydraulically loadable thrust piston unit articulated to the floor sill. The floor sill can be constructed in the manner of a wing laterally on the pedestal mount. The counter-bearing for the thrust piston unit, which is articulated to the pedestal in the lower height region and which extends substantially parallel to the floor sill, is then provided at one end of the wing. The other end of the wing can serve for the fastening of the substructure of the prop.

According to another embodiment of the invention, the loosening tool is mounted to be variable in height. The variability in height can be effected through a telescopability of the pedestal or through a redispostion of the

loosening tool relative to the pedestal then not variable in length.

Advantageously, the loosening tool may be the jet pipe of a hydromechanical extraction device. It is quite possible to effect the water supply to the jet pipe through a hose which absorbs the displacement effected by alignment of the jet pipe and follows this. According to a yet further embodiment of the invention, the jet pipe is however expediently bent at right angles at its end directed away from its mouth and the bent region has a pipe articulation which permits the pivotation of the jet pipe in one plane. A thrust piston unit is advantageously articulated to the parts connected through the pipe articulation. An alignment of the jet pipe in two planes is made possible when a second pipe elbow and a second pipe articulation adjoin the bent region and the pipe articulations are so arranged that one of their axes is aligned substantially vertically and the second substantially horizontally. For the mechanised setting of the jet pipe, a thrust piston unit is also articulated to the parts connected by the second pipe articulation.

It has proved itself particularly in the case of the props to construct these in the manner of a telescope in order to be able without additional components or auxiliary means to adapt to the most diverse height differences present between floor and roof of the seam and to assure a universal use.

A preferable accommodation of the control elements of the hydraulic components results when one of the frame elements is equipped with a closed box, which has the valves determining the loading of the thrust piston unit and props and which can expediently be arranged between or above the thrust piston units of the guide housing. An arrangement of that kind permits short control lines and a compact close construction in connection with a substantially protected accommodation. The control elements determining the operation of the valves are however expediently accommodated in a spatially separate control panel which is connectable with the box having the valves by means of a cable and a plug device associated therewith. It has proved itself to construct the valves to be pneumatically controllable and to equip the cable with a number of compressed air hoses.

When there is talk in the preceding of vertical and horizontal axes or pivot planes, then there is in this case meant always that course of the axes or the planes, respectively, which extends about parallel to the floor or to the roof or about perpendicularly to the roof or the floor of the seam.

The present invention will now be more particularly described, by way of example, with reference to the accompanying drawings in which:

Figure 1 shows a face to be travelled to in vertical longitudinal section and a side elevation of a hydromechanical extraction device;

Figure 2 shows a plan view of Fig. 1 in horizontal longitudinal section with the extraction device in the plan view;

Figure 3 shows the extraction device according to Figs. 1 and 2 in the plan view in a changed working position;

Figure 4 shows the extraction device according to the Figs. 1 and 2 in a once again changed working position in the plan view;

Figure 5 shows the extraction device in the plan view in a third working position;

Figure 6 shows the control panel of the extraction device with associated connecting cable; and

Figure 7 shows another embodiment of one of the frame elements.

Referring now to the accompanying drawings, in Figs. 1 and 2, 1 designates a face to be travelled to with the aid of a hydromechanical extraction device 2. The adit end is designated by 3.

The extraction device has two frame elements 4 and 5. The frame element 4 comprises a falt rectangular guide housing 6, to which a plate-like support skid 8 is laterally articulated through a vertical hinge 7. The support skid severs the bearing of a hydraulically loadable prop 9, which is braceable between the floor 10 and the roof 11. A vertical hinge 7 is also provided on the other side of the guide housing 6, as is evident particularly from Figs. 3 to 5. The support skid 8 can consequently be articulated together with the prop 9 also on the other side of the guide housing 6.

The guide housing 6 is penetrated in longitudinal direction with sliding play by a likewise flat rectangular guide beam 12. The relative motion between the guide beam and the guide housing is effected by two hydraulically loadable thrust piston units 13 arranged in longitudinal direction in the lateral regions of the guide housing. The cylinders 14 of the thrust piston units by their forked ends 15 engage around bearing webs 16 projecting vertically from the surface of the guide housing and are articulatedly connected with these through horizontal bolts 17. The forked ends 18 of the piston rods 19 of the thrust piston units engage around bearing webs 20 projecting vertically from the surface of the guide beam and are articulatedly coupled with these likewise through horizontal bolts 21.

The end section 22, facing the frame element 5, of the the guide beam 12 is constructed to be smaller by comparison with the longitudinal section penetrating through the guide housing 6. It engages into a not more closely illustrated recess of the floor sill 23, constructed in the manner of a wing, of the frame element 5, and is connected with the floor sill through a horizontal hinge 24. Fastened to one end of the wing is a rearwardly

projecting fork strap 25, into which engages the piston rod head of a thrust piston unit 26 and is connected with this through a vertical bolt 27. The cylinder 28 of this thrust piston unit is connected through a vertical bolt 29 with the narrow end section 22 of the guide beam 12. The connection takes place through a double fork strap 30, which is fastened on the end section 22. The double fork strap is illustrated only in the Fig. 2. The upper end of the wing possesses a vertical hinge 31, to which is fastened a dish-like support skid 32, on which is mounted a hydraulically loadable prop 33, which is braceable between the floor 10 and the roof 11.

With approproate loading of the thrust piston units 13 as well as of the props 9 and 33, one of the frame elements 4 and 5 at a time can consequently be redisposed while being supported on the other frame element. When also the thrust piston unit 26 is still actuated at the same time, then the frame elements can also still be pivoted relative to each other.

A pedestal 35, rotatable about a vertical axis 34, is mounted centrally of the floor sill 23, structured in the manner of a wing, of the frame element 5. The rotatability of the pedestal is effected by a thrust piston unit 36, which extends about parallel to the floor sill and is articulated by its cylinder 37 to a bearing block 38 of the floor sill end by its piston rod end to the pedestal 35.

A swivel fork 39 is fastened by a vertical hinge to the upper end of the pedestal 35. The jet pipe 40 of the hydromechanical extraction device 2 is suspended in this swivel fork to be vertically articulated by means of a horizontal bolt 41. The vertical movability of the jet pipe is effected through a hydraulically loadable thrust piston unit 42, the cylinder 43 of which is articulatedly fastened to the pedestal 35 and the piston rod 44 of which to the jet pipe.

The jet pipe 40 is connected through a quick-release coupling 45 with a feed hose 46.

Designated by 47 is a flood or slurry trough, through which the mineral loosened from the adit end 3 is conveyed away.

It is recognisable from Fig. 1 that the arrangement of the jet pipe 40 is so designed that is is pivotable out of the horizontal position upwardly through an angle of 25° and downwardly through an angle of 45° with the aid of the thrust piston unit 42. It is to be seen from Fig. 2 that the jet pipe can be pivoted out of the vertical longitudinal plane through 30° in the one direction and through 50° in the other direction with the aid of the thrust piston unit 36.

Should it thereagainst be required to pivot the jet pipe 40 also in the other direction through an angle of beyond 30° (see Fig. 3), for example through 45°, then with the aid of the thrust piston unit 26, the guide beam 12 and thereby the guide housing 6 can now be pivoted around the axis 24 relative to the frame element 5. The frame element 5 is braced between the floor and the roof of the seam through the prop 33 associated with it and the prop 9 associated with the frame element 4 is released.

When a correction of direction of the face 1 is for example to be performed, as indicated in Fig. 4 then this can be effected thereby, that at first the prop 9 associated with the guide housing 6 is released and the frame element 4 is pivoted through the required amount with the aid of the thrust piston unit 26 with the frame element 5 located fast. Subsequently, the prop 9 associated with the frame element 4 is braced between floor and roof of the seam and the prop 33 associated with the frame element 5 is released. Now, the frame element 5 can again through appropriate loading of the thrust piston unit 26 be pivoted into the desired direction around the hinge 4 between the guide beam 12 and the floor sill 23.

From Fig. 5, there is evident an operating position of the hydromechanical extraction device 2, in which the adjoining field 48 is worked in backfilling after travelling to the face 1. For this purpose, the frame element 5 is pivoted with the aid of the thrust piston unit 26 and the pedestal 35 with the aid of the thrust piston unit 36 so far relative to the guide beam 12 that the longitudinal axis of the jet pipe 40 is disposed at an angle of 75° to the longitudinal axis of the face 1. It is secured by this arrangement that the loosened mineral can readily flow away over the floor, inclined by reason of the tilted face, into the flood or slurry trough 47. Also in this case, the now rearwardly directed walking process of the extraction device 2 is effected by appropriate loading of the props 9 and 33 associated with the two frame elements 4 and 5 as well as of the thrust piston units 13 between the guide beam 12 and the guide housing 6. It can then in a given case be of advantage when the feed hose 46 is connected to the jet pipe 40 through a ball joint coupling in the region 49. A still further relieving of the hose from movements initiated by the pivotation of the jet pipe 40 may be attained when the jet pipe is constructed to be bent twice and equipped with pipe articulations absorbing the pivotal movements.

To be able to load the thrust piston units as well as the props over relatively short hydraulic lines, the valves effecting the loading of these hydraulic units are expediently accommodated in a closed box 50 illustrated in Fig. 1. With the arrangement of this box between and/or above the thrust piston units 13, a close and at the same time protected accommodation of the valves is attained. The control of these valves is expediently effected pneumatically. The control elements 51 (Fig. 6),

arranged in front of the valves and determining their respective settings, are expediently arranged externally of the range of action of the equipment so that the operator of the control elements is endangered neither through walking motions of the extraction device 2 nor through pivotal motions of the jet pipe 40. The control elements are connected with the valves provided in the box 4 through a cable 52, of appropriate length, which is connectable to the box 50 by means of a plug device 53. The control elements 51 are clearly arranged in a control panel 54 and the cable 52 is equipped with a number of compressed air hoses 55, which are recognisable at the fracture location of the cable 52 shown broken in Fig. 6 and which correspond in number with the pneumatic setting units to be actuated of the valves.

The supply of the control operated by compressed air can take place from the compressed air mains usually provided at the face. When a hydraulic mains is also provided at the face, then the supply of the thrust piston units and props can also take place from these mains. When however only a compressed air mains is present, then a separate supply device is expediently employed, which is likewise connected to the compressed air mains and has a compressed air motor and a hydrulic pump driven by this as well as a hydraulic reservoir. Expediently, also this pressure medium supply unit is accommodated externally of the direct circle of action of the hydromechanical extraction device 2.

The cable 52 is dimensioned to be so long that the control panel is erectable so far removed from the hydromechanical extraction device 2 that on the one hand the device and its progress of motion as well as the winning process can be predicted and more easily controllable through this survey. On the other hand, the control device as well as in a given case the device for the hydraulic pressure supply is however so far removed that it does not restrict the winning process and the mobility of the hydraulic extraction device and the operator of the control device is withdrawn from any kind of endangering through the hydromechanical extraction device and the jet pipe thereof and such an endangering is also excluded when the hose 46 under its working load with pressurised water is separated from the extraction device or destroyed through external influence.

A modification of the front frame element of the hydromechanical extraction device is shown in Fig. 7. A prop 56, extendible in the manner of a telescope, is provided for the bracing of the frame element. By means of this prop greater height differences between the roof and the floor can be compensated. The jet pipe 58 is provided with an interchangeable nozzle 59, and the angled-away rear end of the jet pipe is connected to a pipe elbow 61 by means of a pipe articulation 60. The pipe elbow 61 on its part is connected through a pipe articulation 62 to a second pipe elbow 63, which is coupled by means of a coupling with the hose 64. The pipe elbow 61 is coupled to lever members 65 and 66 which engage thrust piston units 67 and 68 respectively. The piston units 67 and 68 serve for the height adjustment of the jet pipe through rotation of the first pipe articulation 60 and for horizontal pivotation through twisting of the pipe elbow 61 against the base plate 23. Thus, the rotation of the jet pipe is substantially taken up by the rotation of the pipe articulations 60 and 62, and the hose 64 does not need to effect the pivotal movement of the jet pipe. A further relief of the hose from a kink-promoting load can be provided in that the coupling connecting the pipe elbow 63 and the hose 64 corresponding to position 49 in Fig. 5 is provided with a ball joint.

CLAIMS

1. Apparatus for working of minerals in a mine, the apparatus being provided with a mounting comprising first and second support member, first hydraulically operable means so arranged as to vary the relative position of the support members to thereby locate the mounting in a desired operating position thereof, second hydraulically operable means associated with the first and second support members and arranged to brace the mounting between the roof and the floor of the mine, and a recoilable work tool so arranged on a bracket member mounted to the first support member as to be pivotable about a substantially vertical axis.

2. Apparatus as claimed in claim 1, wherein the first hydraulically operable means is arranged to cause the first and second support members to be pivotable horizontally relative to each other.

3. Apparatus as claimed in either claim 1 or claim 2, wherein the first support member is connected through a horizontally arranged hinge to be pivotable about the vertical axis and through a hydraulically loadable thrust piston device with a guide beam, the second support member being provided with a guide housing and the first hydraulically operable means being provided with at least one hydraulically loadable thrust piston device, the guide beam penetrating the guide housing in the longitudinal direction thereof and being connected thereto through the at least one hydraulically loadable thrust piston device.

4. Apparatus as claimed in any one of the preceding claims, wherein the second hydraulically operable means comprises a respective hydraulically loadable prop associated with each of the support members.

5. Apparatus as claimed in any one of the preceding claims, wherein the second hydraulically operable means comprises at least two

hydraulically loadable props associated with at least one of the support members.

6. Apparatus as claimed in any one of the preceding claims, wherein a respective vertically pivotably articulated plate to support the second hydraulically operable means is laterally associated with each of the support members.

7. Apparatus as claimed in any one of the preceding claims, wherein the work tool is mounted in a swivel fork provided at an upper end of the bracket member and pivotable between the roof and the floor of the mine by a hydraulically loadable thrust piston device articulatedly connected to the bracket member.

8. Apparatus as claimed in any one of the preceding claims, wherein the bracket member is mounted to a floor sill of the first support member and pivotable by a hydraulically load thrust piston device articulatedly connected to the floor sill.

9. Apparatus as claimed in any one of the preceding claims, wherein the work tool is so mounted as to be variable in height with respect to the floor of the mine.

10. Apparatus as claimed in any one of the preceding claims, wherein the work tool comprises a jet pipe of a hydromechanical extraction device.

11. Apparatus as claimed in claim 10, wherein the jet pipe is provided at its end with a substantially right-angled bent directed away from the mouth thereof, a pipe articulation being provided at the bent and a thrust piston being articulatedly connected to the jet pipe through the pipe articulation.

12. Apparatus as claimed in claim 11, wherein a pipe elbow and a further pipe articulation adjoin the bent, the pipe articulations being so arranged that the axis of the first-mentioned pipe articulation is substantially vertical and the axis of the further pipe articulation is substantially vertical, a thrust piston device being articulatedly connected to the jet pipe through the further pipe articulation.

13. Apparatus as claimed in any one of the preceding claims, wherein the second hydraulically operable means comprises hydraulically loadable prop means constructed in the manner of a telescope.

14. Apparatus as claimed in any one of the preceding claims, wherein one of the support members is provided with a box comprising valve means to determine loading of the first and second hydraulically operable means.

15. Apparatus as claimed in claim 14, comprising control means to determine the operation of the valve means, the control means being arranged on a control panel connectible to the box through a cable by means of a plug device.

16. Apparatus as claimed in claim 15, wherein the valve means are arranged to be pneumatically controllable, the cable being provided with a plurality of compressed air hoses.

17. Apparatus for working of minerals in a mine, the apparatus being substantially as hereinbefore described with reference to and as shown in Figs. 1 to 4 of the accompanying drawings.

18. Apparatus as claimed in claim 17 and substantially as hereinbefore described with reference to and as shown in Fig. 5 of the accompanying drawings.

19. Apparatus as claimed in either claim 17 or claim 18 and substantially as hereinbefore described with reference to and as shown in Fig. 6 of the accompanying drawings.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1979.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.